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RADIO TEST REPORT – 401375-4TRFWL

Type of assessment:

Final product testing

Applicant:

ABB AS

Product:

Wireless Sensor Module with BLE

Trademark:

ABB Ability™ Smart Sensor

Model:

SmartSensor HCHC

Specifications:

- Low Power 0002 (LP0002) July 15, 2020, Clause 4.10.1
  低功率射頻電機技術規範

Date of issue: August 30, 2021

Andrey Adelberg, Senior EMC/RF Specialist	Adelberg
Tested by	Signature
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Reviewed by	Signature

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SCC File Number: 15064 (Ottawa/Almonte); 151100 (Montreal); 151097 (Cambridge)

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Test site registration	**Organization**	**Recognition numbers and location**		
	FCC/ISED	FCC: CA2040; IC: 2040A-4 (Ottawa/Almonte); FCC: CA2041; IC: 2040G-5 (Montreal); CA0101 (Cambridge)		
Website	www.nemko.com			

Limits of responsibility

Note that the results contained in this report relate only to the items tested and were obtained in the period between the date of initial receipt of samples and the date of issue of the report.
This test report has been completed in accordance with the requirements of ISO/IEC 17025. All results contained in this report are within Nemko Canada's ISO/IEC 17025 accreditation.

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Report summary

1.1 Test specifications

LP0002 July 15, 2020, Clause 4.10.1 低功率射頻電機技術規範	Intentional radiators employing frequency hopping spread spectrum and digital modulation techniques. Operation within the bands 2400–2483.5 MHz and 5725–5850 MHz

1.2 Test methods

558074 D01 15.247 Meas Guidance v05r02 (April 2, 2019)	Guidance for compliance measurements on digital transmission system, frequency hopping spread spectrum system, and hybrid system devices operating under section 15.247 of the FCC rules.
ANSI C63.10 v2013	American National Standard of Procedures for Compliance Testing of Unlicensed Wireless Devices

1.3 Exclusions

None

1.4 Statement of compliance

In the configuration tested, the EUT was found compliant.

Testing was performed against all relevant requirements of the test standard except as noted in section 1.3 above. Results obtained indicate that the product under test complies In full with the requirements tested. The test results relate only to the items tested.

See "Summary of test results" for full details.

1.5 Test report revision history

Table 1.5-1: *Test report revision history*

Revision #	Date of issue	Details of changes made to test report
TRF	August 30, 2021	Original report issued

Engineering considerations

2.1 Modifications incorporated in the EUT for compliance

There were no modifications performed to the EUT during this assessment.

Section 2

2.2 Technical judgment

None

2.3 Model variant declaration

None

2.4 Deviations from laboratory tests procedures

No deviations were made from laboratory procedures.

Test conditions

3.1 Atmospheric conditions

Temperature	15 °C – 35 °C
Relative humidity	20 % – 75 %
Air pressure	86 kPa (860 mbar) – 106 kPa (1060 mbar)

When it is impracticable to carry out tests under these conditions, a note to this effect stating the ambient temperature and relative humidity during the tests shall be recorded and stated.

3.2 Power supply range

The normal test voltage for equipment to be connected to the mains shall be the nominal mains voltage. For the purpose of the present document, the nominal voltage shall be the declared voltage, or any of the declared voltages ±5 %, for which the equipment was designed.

Measurement uncertainty

4.1 Uncertainty of measurement

UKAS Lab 34 and TIA-603-B have been used as guidance for measurement uncertainty reasonable estimations with regards to previous experience and validation of data. Nemko Canada, Inc. follows these test methods in order to satisfy ISO/IEC 17025 requirements for estimation of uncertainty of measurement for wireless products.

Measurement uncertainty budgets for the tests are detailed below. Measurement uncertainty calculations assume a coverage factor of K = 2 with 95% certainty.

Table 4.1-1: *Measurement uncertainty calculations*

Test name	Measurement uncertainty, ±dB
All antenna port measurements	0.55
Occupied bandwidth	4.45
Conducted spurious emissions	1.13
Radiated spurious emissions	3.78
AC power line conducted emissions	3.55

Information provided by the applicant

5.1 Disclaimer

Section 5

This section contains information provided by the applicant and has been utilized to support the test plan. Inaccurate information provided by the applicant can affect the validity of the results contained within this test report. Nemko accepts no responsibility for the information contained within this section and the impact it may have on the test plan and resulting measurements.

5.2 Applicant/Manufacture

Applicant name	ABB AS Ole
Applicant address	Deviks vei 10 NO-0666 Oslo, Norway
Manufacture name	Same as applicant
Manufacture address	Same as applicant

5.3 EUT information

Product	Wireless Sensor Module with BLE
Model	SmartSensor HCHC
Trademark	ABB Ability™ Smart Sensor
Serial number	C20000C40A
Power supply requirements	Lithium Battery: 3.7 V(DC)
Product description and theory of operation	The EUT is a Wireless Sensor with BLE transmitter and NFC passive receiver and WirelessHART transmitter. This test report covers only BLE transmitter.

5.4 Radio technical information

Category of Wideband Data Transmission equipment	☐ Frequency Hopping Spread Spectrum (FHSS) equipment
	☒ Other types of Wideband Data Transmission equipment (e.g. DSSS, OFDM, etc.).
Frequency band	2400–2483.5 MHz
Frequency Min (MHz)	2402
Frequency Max (MHz)	2480
RF power Max (W), Conducted	0.0059 (for 1 Mbps) and 0.0058 (for 2 Mbps)
Measured BW (kHz), 99% OBW	1067 (for 1 Mbps) and 2071 (for 2 Mbps)
Type of modulation	BLE (GFSK)
Emission classification	F1D
Transmitter spurious, dBµV/m @ 3 m	53.40 at 1188.1 MHz (average)
Antenna information	2 dBi Integral Antenna (U-FL connector on PCB)

5.5 EUT setup details

5.5.1 Radio exercise details

Operating conditions	An Android app CoMo 5.4.1 was used on and Android device to access the test mode. Firmware version: 5.5.3. Input/output signal levels to from EUT: Standard Bluetooth 5 or Bluetooth low energy
Transmitter state	EUT was set to transmit modulated signal at low/mid/top channel with 8 dBm power setting at 1 Mbps or 2 Mbps data rates.

5.5.2 EUT setup configuration

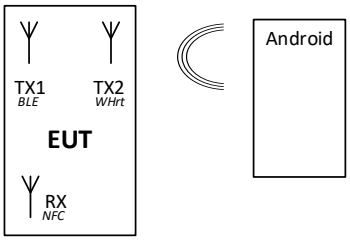

Figure 5.5-1: *Radiated testing block diagram*

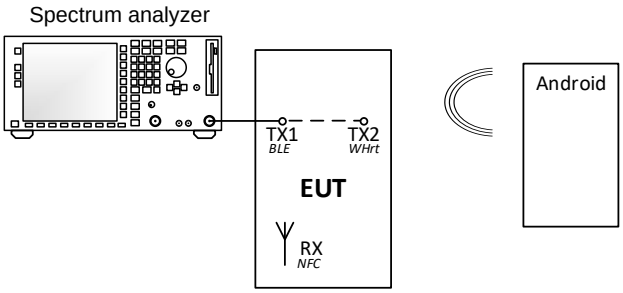

Figure 5.5-2: *Antenna port testing block diagram*

Summary of test results

6.1 Testing location

Test location (s)	Ottawa

Section 6

6.2 Testing period

Test start date	February 22, 2021	Test end date	April 15, 2021

6.3 Sample information

Receipt date	February 19, 2021	Nemko sample ID number(s)	4

6.4 LP0002: 2018, Clause 4.10.1 test results

Table 6.4-1: *LP0002, Clause 4.10.1 requirements results*

Clause	Test description	Verdict
3.3	(傳導限制值) Conducted limits	Not applicable
4.10.1.6 (1) (a)	(跳頻系統) Frequency Hopping Systems requirements, 2 GHz operation	Not applicable
4.10.1.6 (1) (b)	(跳頻系統) Frequency Hopping Systems requirements, 5 GHz operation	Not applicable
4.10.1.2 (1) (A)	(峰值傳導輸出功率) The maximum peak output power and EIRP for FHSS 2 GHz	Not applicable
4.10.1.2 (2)	(峰值傳導輸出功率) The maximum peak output power and EIRP for FHSS 5 GHz	Not applicable
4.10.1.6 (2) (A)	(最小6dB带宽) Minimum 6 dB bandwidth for systems using digital modulation techniques	Pass
4.10.1.2 (1) (C)	(峰值傳導輸出功率) Maximum peak output power and EIRP for DTS in 2.4 GHz	Pass
4.10.1.5	(帶外發射限制) Limits on emissions outside the frequency band	Pass
4.10.1.6 (2) (B)	(峰值传输电功率密度) Power spectral density for digitally modulated devices	Pass

Notes: EUT is battery operated and not an FHSS device.

Test equipment

7.1 Test equipment list

Section 7

Table 7.1-1: *Equipment list*

Equipment	Manufacturer	Model no.	Asset no.	Cal cycle	Next cal.
Signal and Spectrum Analyzer	Rhode&Schwarz	FSW50	FA003267	1 year	December 7, 2021
3 m EMI test chamber	TDK	SAC-3	FA002047	1 year	April 24, 2021
Flush mount turntable	Sunol	FM2022	FA002082	—	NCR
Controller	Sunol	SC104V	FA002060	—	NCR
Antenna mast	Sunol	TLT2	FA002061	—	NCR
Receiver/spectrum analyzer	Rohde & Schwarz	ESU 26	FA002043	1 year	November 6, 2021
Spectrum analyzer	Rohde & Schwarz	FSU	FA001877	1 year	April 31, 2021
Preamp (1–18 GHz)	ETS Lindgren	124334	FA002877	1 year	October 13, 2021
Bilog antenna (20–3000 MHz)	Sunol	JB3	FA002108	1 year	February 2, 2022
Horn antenna (1–18 GHz)	EMCO	3115	FA000825	1 year	April 30, 2021
Horn antenna (18–40 GHz)	EMCO	3116	FA001847	1 year	May 7, 2021
Pre-amplifier (18–26 GHz)	Narda	BBS-1826N612	FA001550	—	VOU

Notes: NCR - no calibration required, VOU - verify on use

Testing data

8.1 (最小6dB带宽) Minimum 6 dB bandwidth for systems using digital modulation techniques

Section 8

8.1.1 References, definitions and limits

LP0002, Clause 4.10.1.6

Other limits:

(2) Digital modulation techniques system:

(A) For digitally modulated systems, the minimum 6 dB bandwidth shall be at least 500 kHz.

8.1.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	April 15, 2021

8.1.3 Observations, settings and special notes

The test was performed as per KDB 558074, section 8.2 with reference to ANSI C63.10 subclause 11.8.
Spectrum analyser settings:

Resolution bandwidth	6 dB BW: 100 kHz; 99% OBW: 1–5% of OBW
Frequency span	5 MHz (for 1 Mbps) and 10 MHz (for 2 Mbps)
Detector mode	Peak
Trace mode	Max Hold

8.1.4 Test data

Table 8.1-1: *6 dB bandwidth results*

Bit rate, Mbps	Frequency, MHz	6 dB bandwidth, MHz	Minimum limit, MHz	Margin, MHz
1	2402	0.784	0.500	0.284
	2440	0.779	0.500	0.279
	2480	0.794	0.500	0.294
2	2402	1.300	0.500	0.800
	2440	1.340	0.500	0.840
	2480	1.420	0.500	0.920

Table 8.1-2: *99% occupied bandwidth results*

Bit rate, Mbps	Frequency, MHz	99% occupied bandwidth, MHz
1	2402	1.049
	2440	1.067
	2480	1.063
2	2402	2.071
	2440	2.060
	2480	2.051

Test data, continued

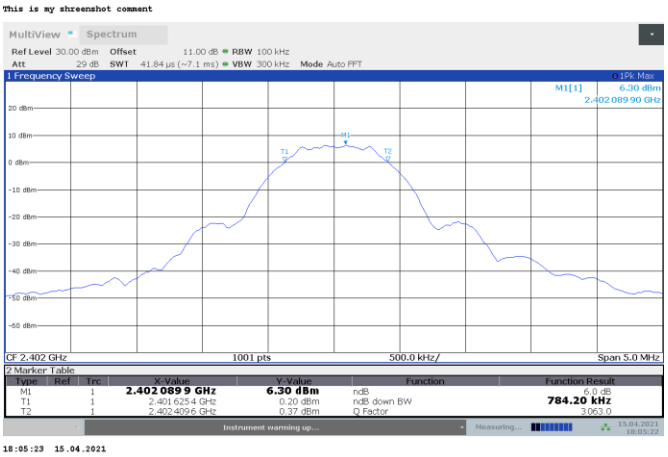

Figure 8.1-1: *6 dB bandwidth on low channel, 1 Mbps*

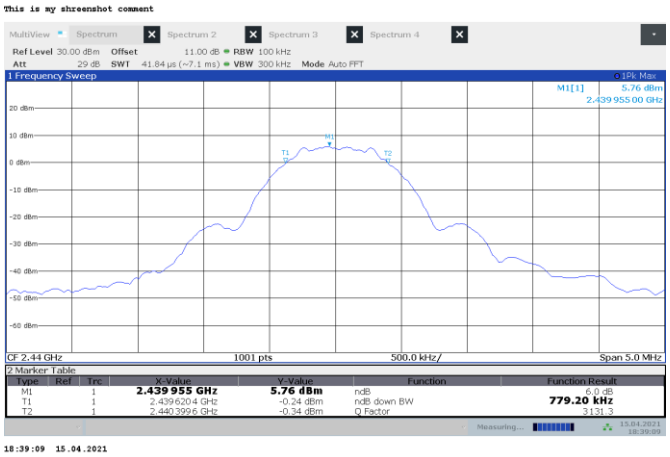

Figure 8.1-2: *6 dB bandwidth on mid channel, 1 Mbps*

Figure 8.1-3: *6 dB bandwidth on top channel, 1 Mbps*

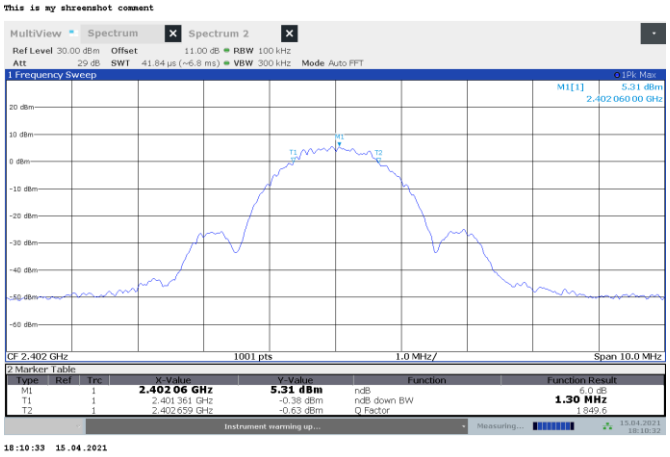

Figure 8.1-4: *6 dB bandwidth on low channel, 2 Mbps*

Test data, continued

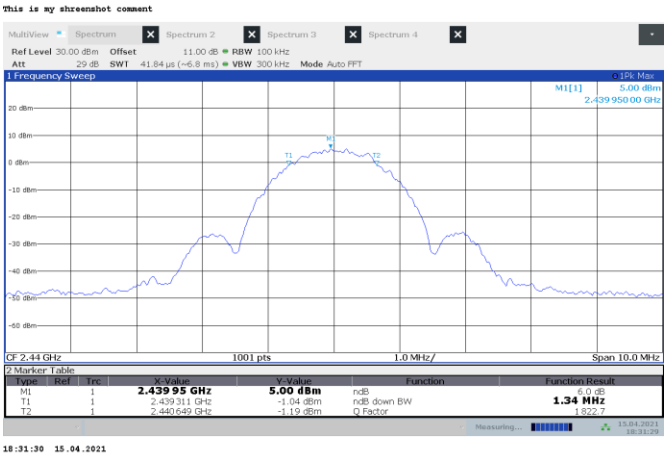

Figure 8.1-5: *6 dB bandwidth on mid channel, 2 Mbps*

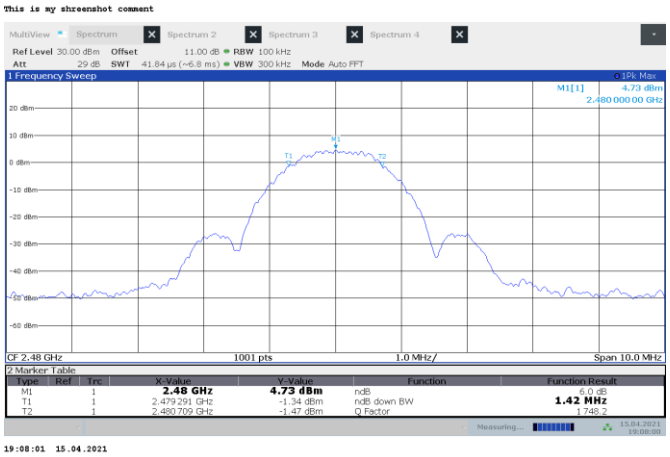

Figure 8.1-6: *6 dB bandwidth on top channel, 2 Mbps*

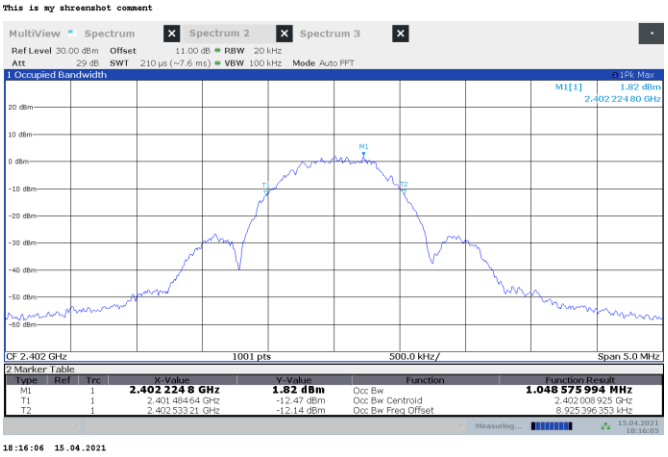

Figure 8.1-7: *99% occupied bandwidth on low channel, 1 Mbps*

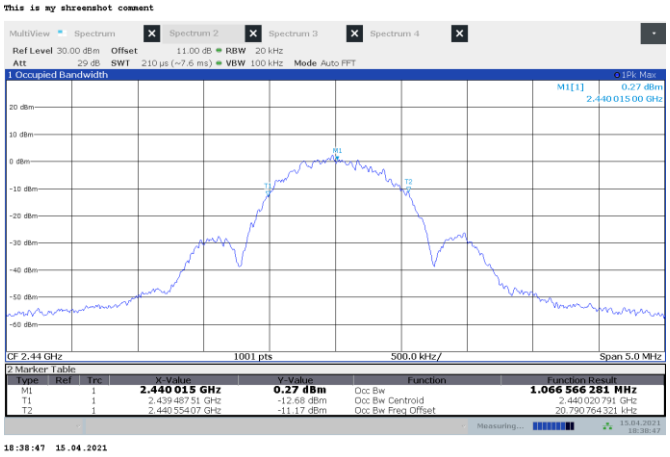

Figure 8.1-8: *99% occupied bandwidth on mid channel, 1 Mbps*

Test data, continued

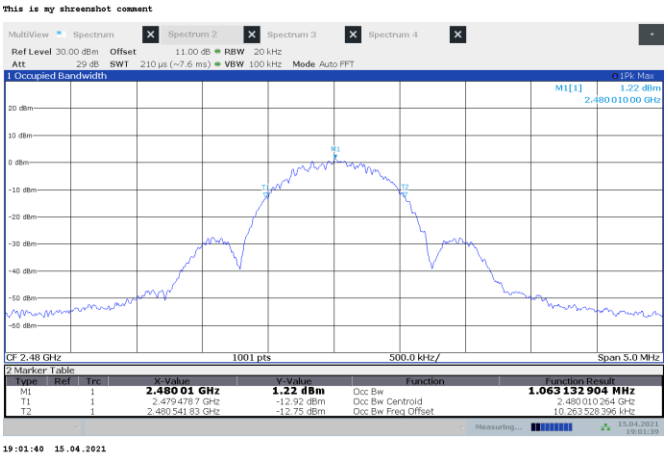

Figure 8.1-9: *99% occupied bandwidth on top channel, 1 Mbps*

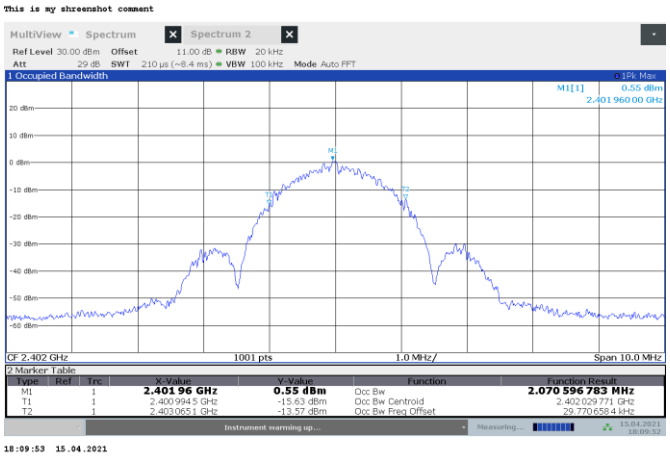

Figure 8.1-10: *99% occupied bandwidth on low channel, 2 Mbps*

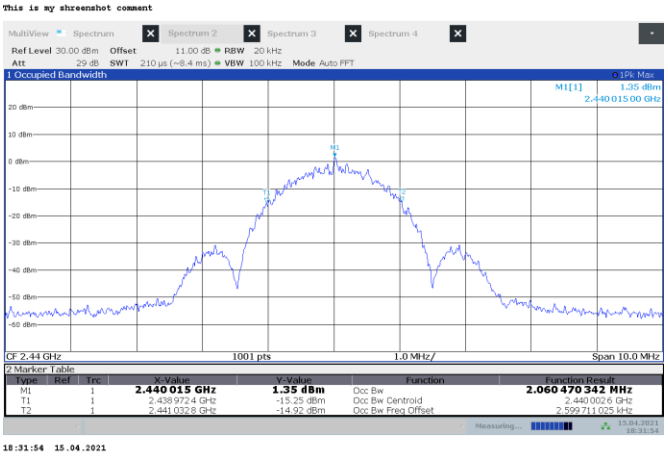

Figure 8.1-11: *99% occupied bandwidth on mid channel, 2 Mbps*

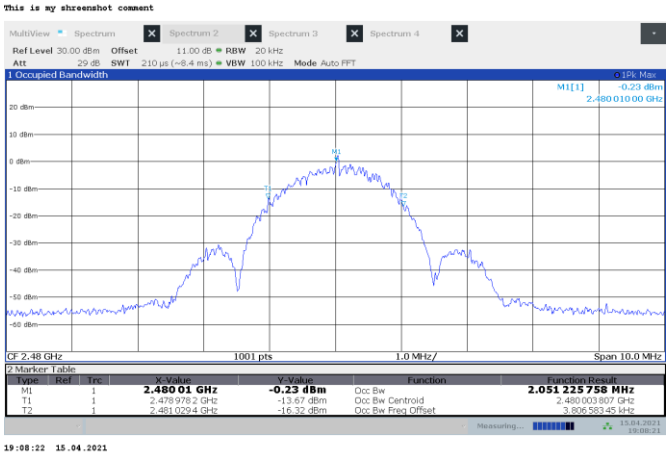

Figure 8.1-12: *99% occupied bandwidth on top channel, 2 Mbps*

8.2 (峰值傳導輸出功率) Maximum peak output power and EIRP for DTS in 2.4 GHz

8.2.1 References, definitions and limits

LP0002, Clause 4.10.1.2

The maximum peak output power:

(1) Operation within 2400 MHz~2483.5 MHz

(C) For systems using digital modulation: below 1 Watt (inclusive).

LP0002, Clause 4.10.1.3

Limits of antenna gains:

(1) For systems operated in the 2400 MHz~2483.5 MHz:

(A) For fixed, point-to-point operations, the peak conducted output power of the intentional radiator shall be reduced by 1 dB for every 3 dBi when the directional gain of the antenna exceeds 6 dBi.

(B) Transmitters that emit multiple directional beams (including simultaneously or sequentially) for the purpose of directing signals to individual receivers or to groups of receivers shall comply with the following requirements:

(a) If the transmitter employs an antenna system that emits multiple directional beams but does not emit multiple directional beams simultaneously, the total output power conducted to the array or arrays that comprise the device shall not exceed the limit specified in paragraph 4.10.1.2 of this section. However, the total conducted output power shall be reduced by 1 dB below the specified limits for each 3 dBi that the directional gain of the antenna/antenna array exceeds 6 dBi. The directional antenna gain shall be computed as follows:

(i) Directional gain = 10×log (number of array elements or staves) + the directional gain of the element or stave having the highest gain.

(ii) A lower value for the directional gain than that calculated in paragraph (i) of this section will be accepted if sufficient evidence is presented, e.g., due to shading of the array or coherence loss in the beam forming.

(b) If a transmitter employs an antenna that operates simultaneously on multiple directional beams using the same or different frequency channel(s), the power supplied to each emission beam shall be subject to the power limit specified in (a). If transmitted beams overlap, the power shall be reduced to ensure that their aggregate power does not exceed the limit specified in (a). In addition, the aggregate power transmitted simultaneously on all beams shall not exceed the limit specified in (a) by more than 8 dB. The directional gain is calculated the same as (a).

(c) Transmitters that emit a single directional beam shall operate under the provisions of (1) (A) and (3) of this section.

(3) When using the transmitting antennas with the directional gain over 6 dBi except for (1) and (2), the maximum conducted output power shall be reduced in equal quantity according to the total dBi of the antenna directional gain over 6 dBi.

8.2.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	April 15, 2021

8.2.3 Observations, settings and special notes

The test was performed as per KDB 558074, section 8.3 with reference to ANSI C63.10 subclause 11.9.1 (peak power) using method RBW≥DTS bandwidth (Maximum peak conducted output power)
Spectrum analyser settings:

Resolution bandwidth	5 MHz
Frequency span	30 MHz
Detector mode	Peak
Trace mode	Max-hold

8.2.4 Test data

Table 8.2-1: *Output power and EIRP results (antenna port measurement)*

Data rate. Mbps	Frequency, MHz	Conducted output power, dBm	Output power limit, dBm	Output power margin, dB	Antenna gain, dBi	EIRP, dBm	EIRP limit, dBm	EIRP margin, dB
1	2402	7.69	30.00	22.31	2.00	9.69	36.00	26.31
1	2440	7.60	30.00	22.40	2.00	9.60	36.00	26.40
1	2480	7.29	30.00	22.71	2.00	9.29	36.00	26.71
2	2402	7.63	30.00	22.37	2.00	9.63	36.00	26.37
2	2440	7.61	30.00	22.39	2.00	9.61	36.00	26.39
2	2480	7.29	30.00	22.71	2.00	9.29	36.00	26.71

Note: EIRP [dBm] = Conducted output power [dBm] + Antenna gain [dBi]

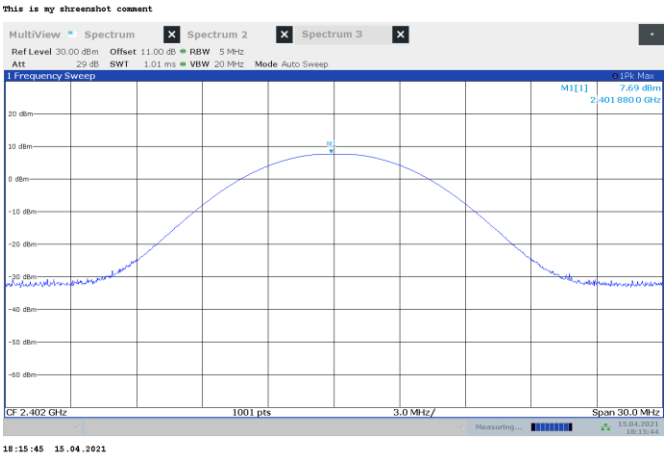

Figure 8.2-1: *Output power on low channel with 1 Mbps*

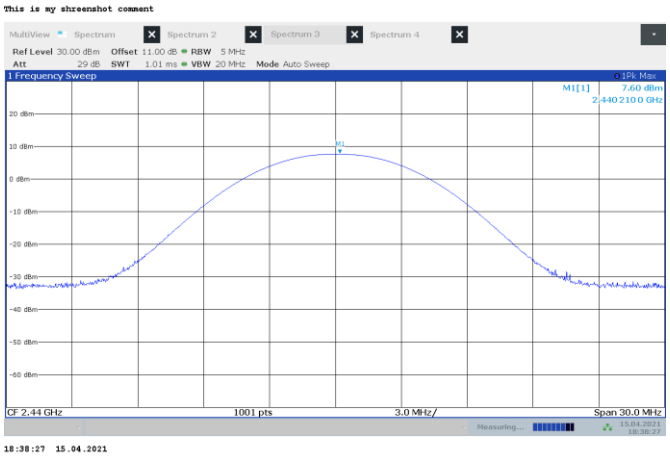

Figure 8.2-2: *Output power on mid channel with 1 Mbps*

Test data, continued

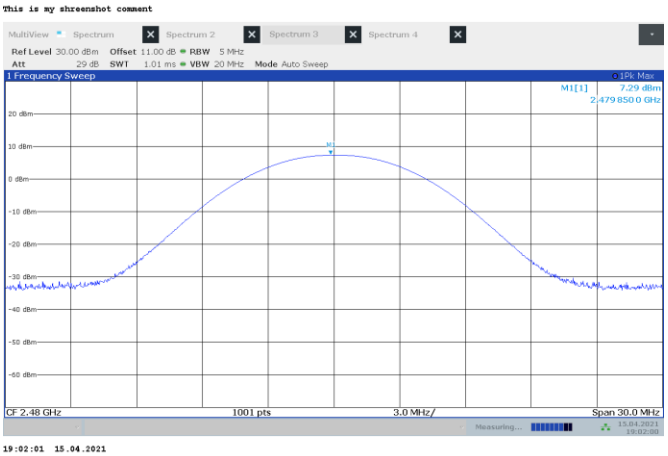

Figure 8.2-3: *Output power on high channel with 1 Mbps*

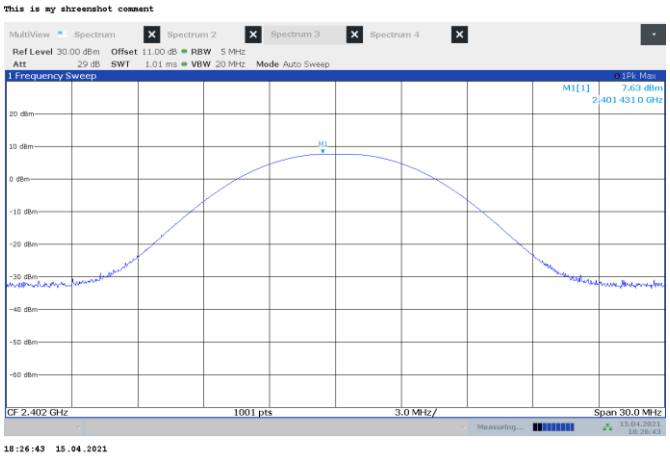

Figure 8.2-4: *Output power on low channel with 2 Mbps*

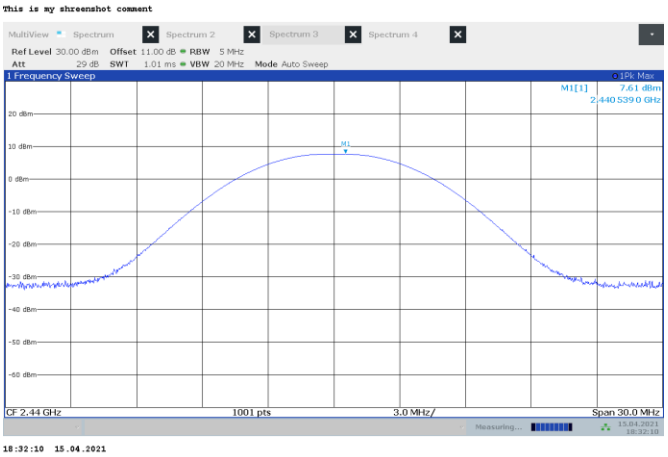

Figure 8.2-5: *Output power on mid channel with 2 Mbps*

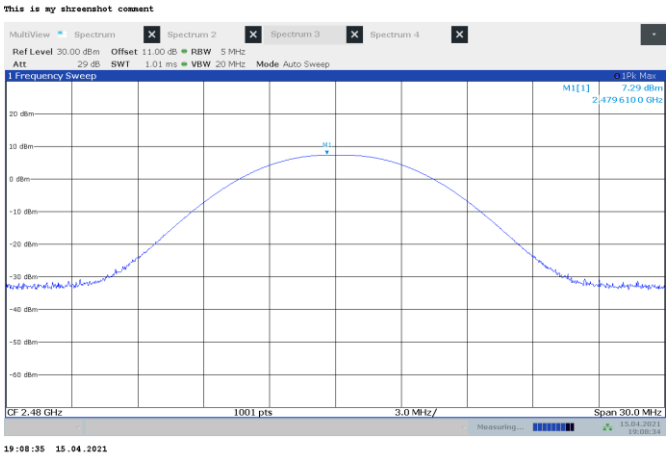

Figure 8.2-6: *Output power on high channel with 2 Mbps*

8.3 (帶外發射限制) Limits on emissions outside the frequency band

8.3.1 References, definitions and limits

LP0002, Clause 4.10.1.5

Limits on emissions outside the frequency band:

In any 100 kHz bandwidth outside the frequency band in which the spread spectrum or digitally modulated intentional radiator is operating, the radio frequency power that is produced by the intentional radiator below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power, the attenuation shall be as below:

(1) The attenuation shall be at least 20 dB when the conducted power is measured according to Appendix II of this section, based on either an RF conducted or a radiated measurement.

(2) The attenuation shall be at least 30 dB when the conducted power is measured according to the paragraph (1) (C) of this section 4.10.1.2.

In addition, radiated emissions that fall under Section 3.5 the restricted bands must also comply with the radiated emission limit specified in Section 3.6.

LP0002, Clause 3.5:

Additional regulations shall apply except for this standard. The fundamental frequency of any low-power radio-frequency devices shall be restricted in any of the operation bands listed below; spurious emissions shall be permitted in any of frequency band listed below and shall meet the field strength requirement of 3.6:

Table 8.3-1: *Section 3.5 restricted frequency bands*

MHz	MHz	MHz
0.090–0.110	240.00–285.00	3332.0–3339.0
0.490–0.510	322.00–335.40	3345.8–3358.0
2.172–2.198	399.90–410.00	3500.0–4400.0
3.013–3.033	485.00–510.00	4500.0–5250.0
4.115–4.198	608.00–614.00	5350.0–5460.0
5.670–5.690	703.00–748.00	7250.0–7750.0
6.200–6.300	758.00–803.00	8025.0–8500.0
8.230–8.400	825.00–915.00	9000.0–9200.0
12.265–12.600	930.00–1240.0	9300.0–9500.0
13.340–13.430	1300.0–1427.0	10600–12700
14.965–15.020	1435.0–1626.5	13250–13400
16.700–16.755	1660.0–1785.0	14470–14500
19.965–20.020	1805.0–1880.0	15350–16200
25.500–25.700	1885.0–1900.0	17700–21400
37.475–38.275	1905.0–1985.0	22010–23120
73.500–75.400	2010.0–2025.0	23600–24000
108.00–138.00	2110.0–2170.0	31200–31800
149.90–150.05	2200.0–2300.0	36430–36500
156.70–156.90	2310.0–2390.0	Above 38600
162.01–167.17	2483.5–2900.0	
167.72–173.20	3260.0–3267.0	

References, definitions and limits, continued

LP0002, Clause 3.6:

Additional regulations shall apply except for this standard, the emissions from the low-power radio-frequency devices shall be less than or equal the field strength levels specified in the following table and the level of any unwanted emissions shall not exceed the level of the fundamental emission. The tighter limit applies at the band edges.

Table 8.3-2: *Section 3.6 Radiated emission limits*

	Field strength of emissions		
Frequency, MHz	**µV/m**	**dBµV/m**	**Measurement distance, m**
0.009–0.490	2400/**F**	67.6 – 20 × $\log_{10}$(**F**)	300
0.490–1.705	24000/**F**	87.6 – 20 × $\log_{10}$(**F**)	30
1.705–30.0	30	29.5	30
30–88	100	40.0	3
88–216	150	43.5	3
216–960	200	46.0	3
above 960	500	54.0	3

Notes: In the emission table above, the tighter limit applies at the band edges. **F** is in kHz units
For frequencies above 1 GHz the limit on peak RF emissions is 20 dB above the maximum permitted average emission limit applicable to the equipment under test

LP0002, Clause 3.7:

The field strength radio frequency 9–90 kHz, 110–490 kHz and 1000 MHz above stipulated in the above table shall be measured according to an average detector and comply with Section 6.15.2, while others shall be measured using a CISPR quasi-peak detector.

LP0002, Clause 6.15.2:

On any frequency of frequencies above 1000 MHz, the radiated limits shown are based upon the use of measurement instrumentation employing an average detector function. When average radiated emission measurements are specified in the regulations (including emission measurements below 1000 MHz), there is also a limit on the radio frequency emissions, as measured using instrumentation with a peak detector function, corresponding to 20 dB above the maximum permitted average limit for the frequency being investigated unless a different peak emission limit is otherwise specified in the rules. Unless otherwise specified, measurements above 1000 MHz shall be undertaken using a minimum resolution bandwidth of 1MHz.

8.3.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	February 22, 2021

8.3.3 Observations, settings and special notes

- As part of the current assessment, the test range of 9 kHz to 10th harmonic has been fully considered and compared to the actual frequencies utilized within the EUT. Since the EUT contains a transmitter in the GHz range, the EUT has been deemed compliant without formal testing in the 9 kHz to 30 MHz test range, therefore formal test results (tabular data and/or plots) are not provided within this test report.
- EUT was set to transmit with 100 % duty cycle.
- Radiated measurements were performed at a distance of 3 m below 18 GHz and a distance of 1 m above 18 GHz.
- Radiated measurements were performed while sample operates in its worst-case data rate with respect to the power density: 1 Mbps.
- Both formfactor types were assessed radiated: BASA and HCHC (as a representative one).
- DTS emissions in non-restricted frequency bands test was performed as per KDB 558074, section 8.5 with reference to ANSI C63.10 subclause 11.11.
- Since fundamental power was tested using the maximum peak conducted output power procedure to demonstrate compliance, the spurious emissions limit is −20 dBc/100 kHz.
- DTS emissions in restricted frequency bands test was performed as per KDB 558074, section 8.6 with reference to ANSI C63.10 subclause 11.12.
- DTS band-edge emission measurements test was performed as per KDB 558074, section 8.7 with reference to ANSI C63.10 subclause 11.13.

Spectrum analyser settings for radiated measurements within restricted bands below 1 GHz:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for peak radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	3 MHz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for average radiated measurements within restricted bands above 1 GHz:

Resolution bandwidth:	1 MHz
Video bandwidth:	10 Hz
Detector mode:	Peak
Trace mode:	Max Hold

Spectrum analyser settings for conducted spurious emissions measurements:

Resolution bandwidth:	100 kHz
Video bandwidth:	300 kHz
Detector mode:	Peak
Trace mode:	Max Hold

8.3.4 Test data

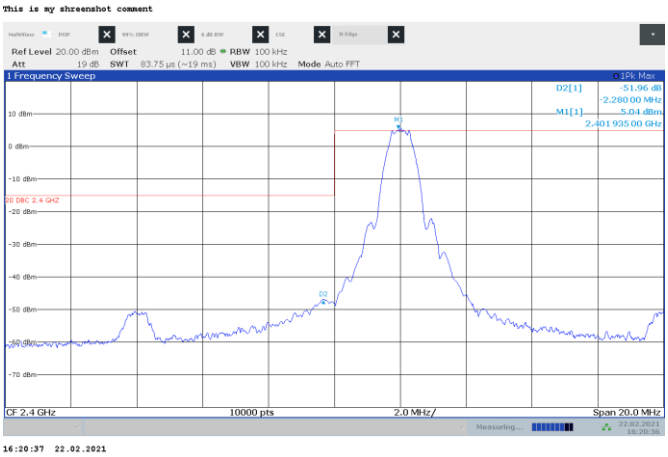

Figure 8.3-1: *Conducted band edge spurious emissions at 2400 MHz for 1 Mbps*

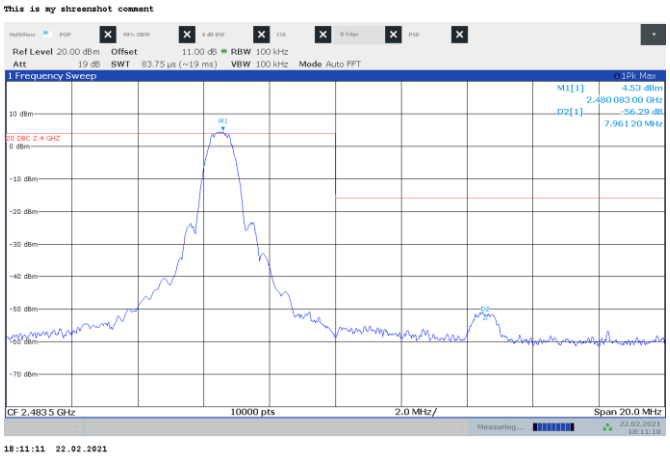

Figure 8.3-2: *Conducted band edge spurious emissions at 2483.5 MHz for 1 Mbps*

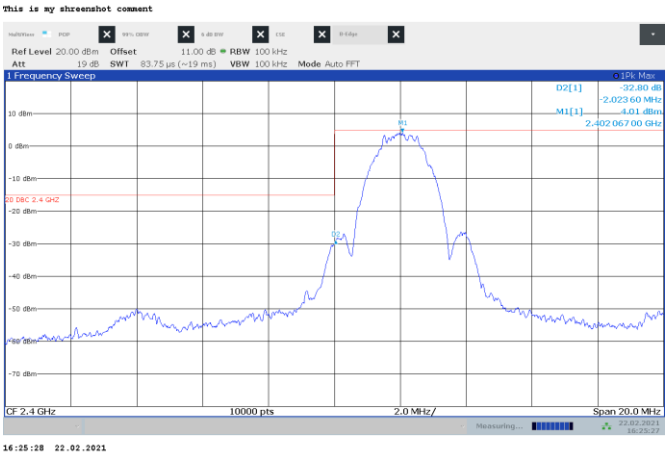

Figure 8.3-3: *Conducted band edge spurious emissions at 2400 MHz for 2 Mbps*

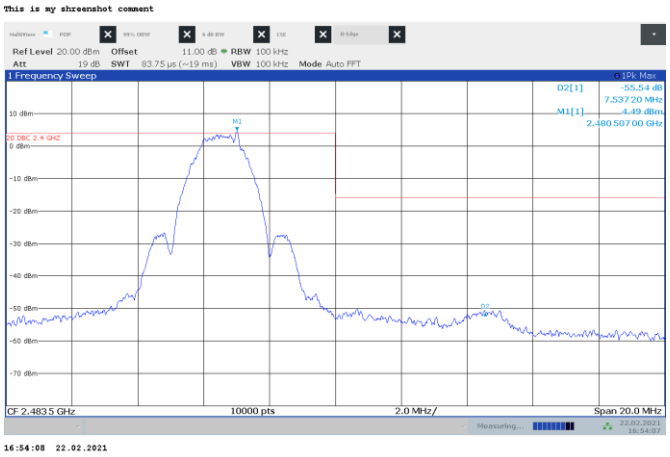

Figure 8.3-4: *Conducted band edge spurious emissions at 2483.5 MHz for 2 Mbps*

Test data, continued

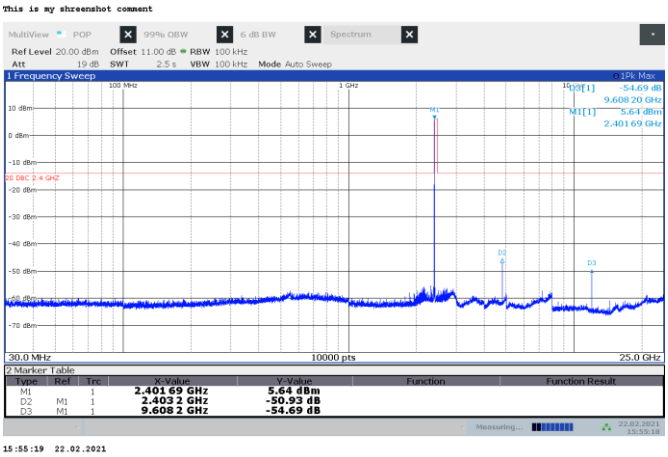

Figure 8.3-5: *Conducted spurious emissions on low channel at 1 Mbps*

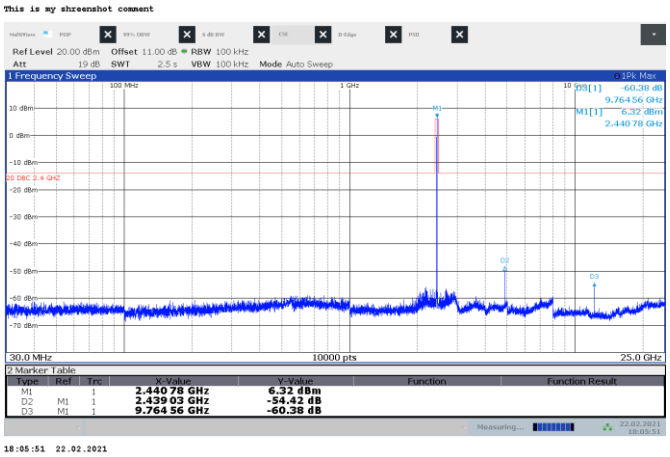

Figure 8.3-6: *Conducted spurious emissions on mid channel at 1 Mbps*

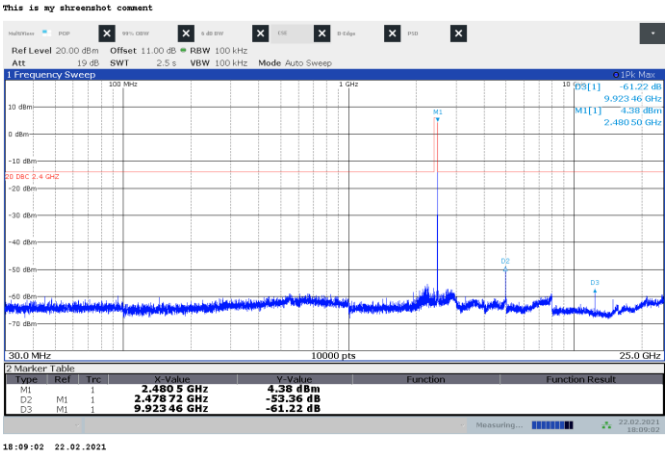

Figure 8.3-7: *Conducted spurious emissions on high channel at 1 Mbps*

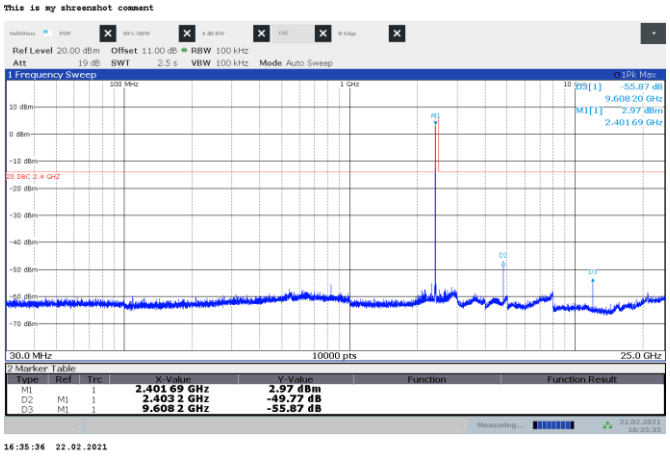

Figure 8.3-8: *Conducted spurious emissions on low channel at 2 Mbps*

Test data, continued

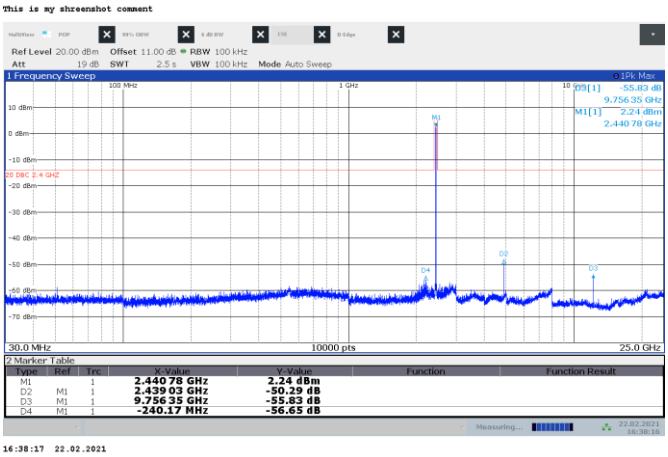

Figure 8.3-9: *Conducted spurious emissions on mid channel at 1 Mbps*

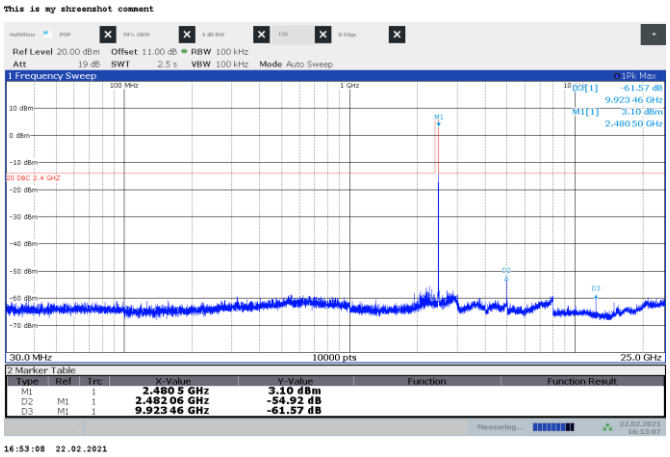

Figure 8.3-10: *Conducted spurious emissions on high channel at 2 Mbps*

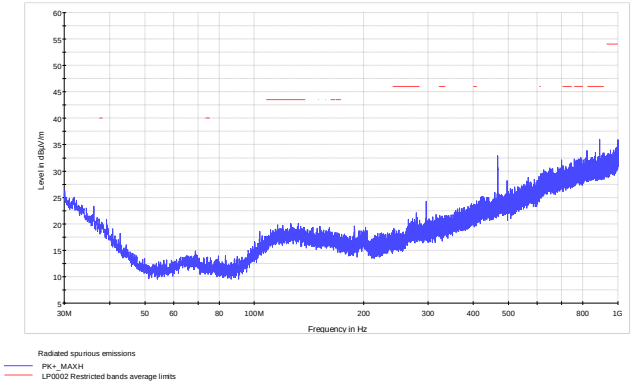

Figure 8.3-11: *Radiated spurious emissions within 30–1000 MHz, low channel*

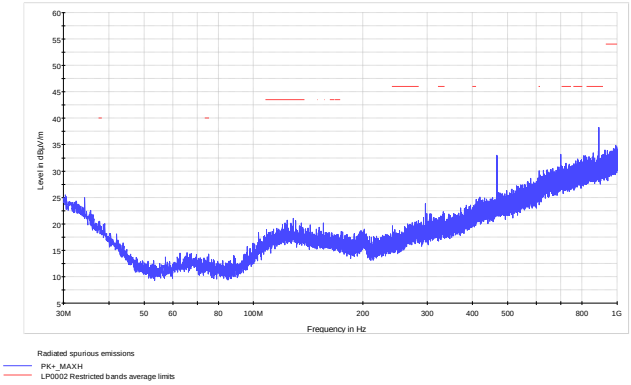

Figure 8.3-12: *Radiated spurious emissions within 30–1000 MHz, mid channel*

Test data, continued

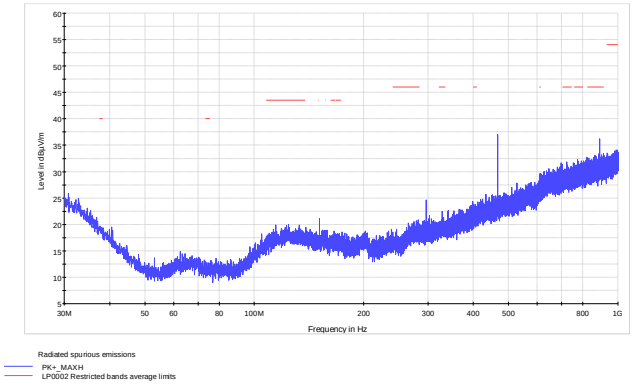

Figure 8.3-13: *Radiated spurious emissions within 30–1000 MHz, high channel*

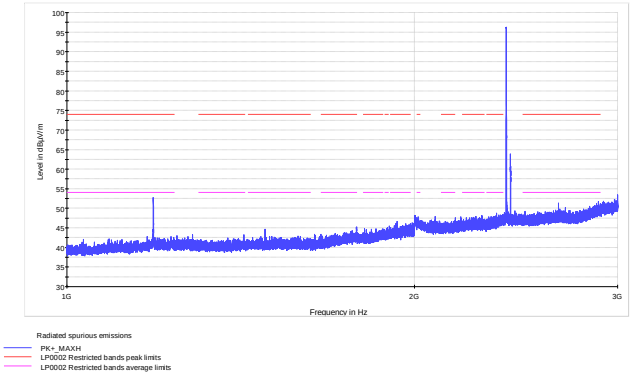

Figure 8.3-14: *Radiated spurious emissions within 1–3 GHz, low channel*

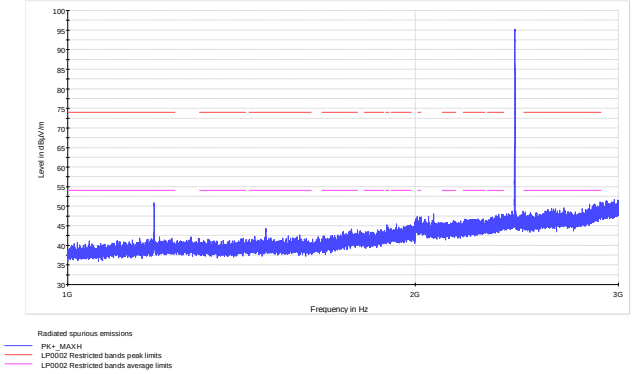

Figure 8.3-15: *Radiated spurious emissions within 1–3 GHz, mid channel*

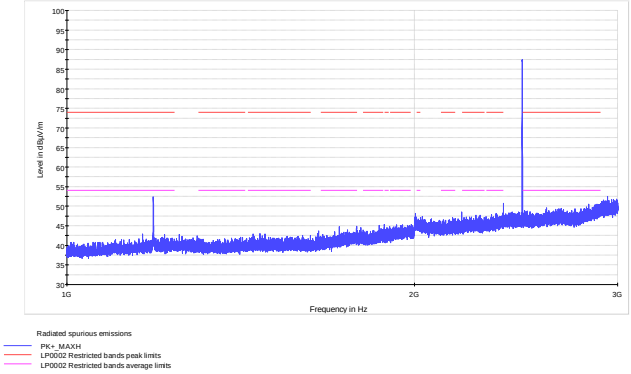

Figure 8.3-16: *Radiated spurious emissions within 1–3 GHz, high channel*

Test data, continued

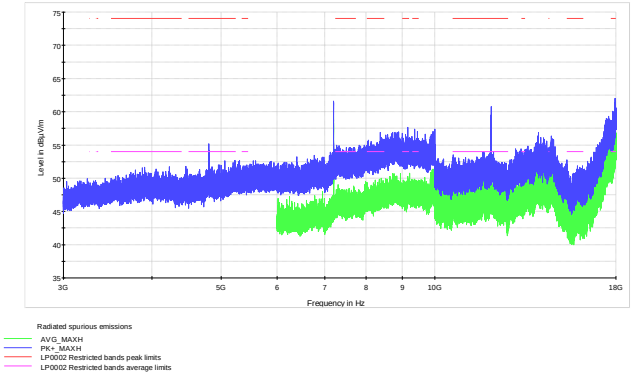

Figure 8.3-17: *Radiated spurious emissions within 3–18GHz, low channel*

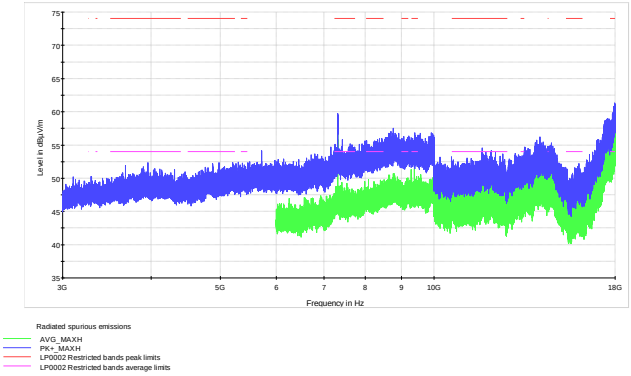

Figure 8.3-18: *Radiated spurious emissions within 3–18 GHz, mid channel*

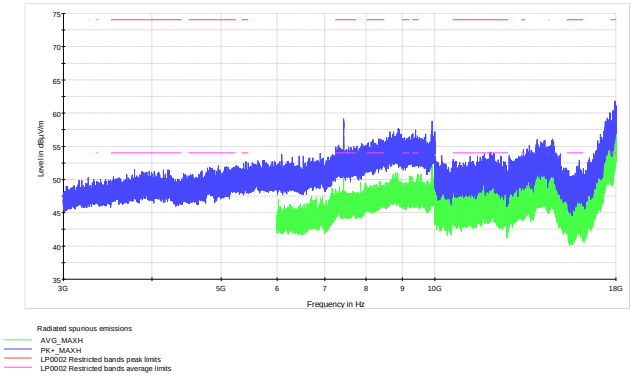

Figure 8.3-19: *Radiated spurious emissions within 3–18GHz, high channel*

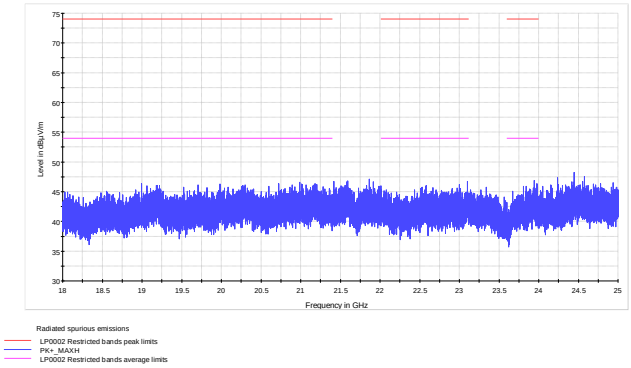

Figure 8.3-20: *Radiated spurious emissions within 18–25 GHz, low channel*

Test data, continued

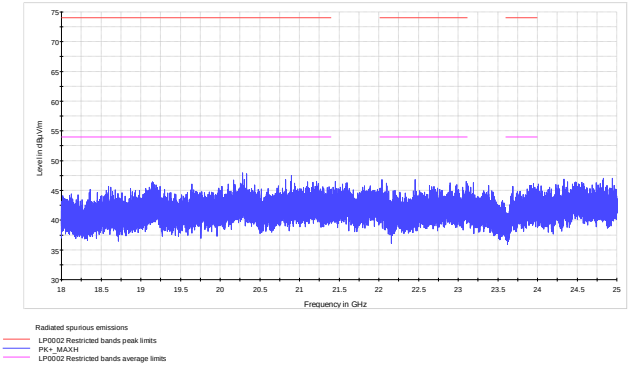

Figure 8.3-21: *Radiated spurious emissions within 18–25 GHz, mid channel*

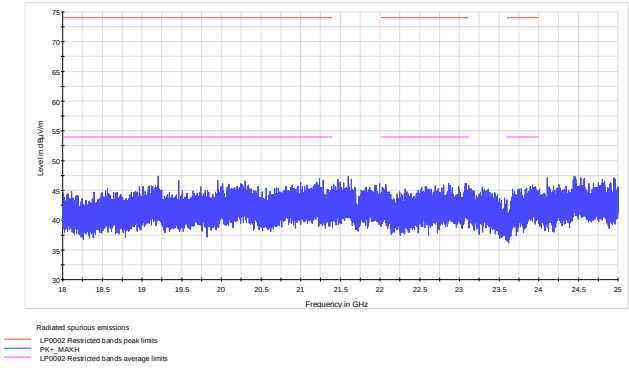

Figure 8.3-22: *Radiated spurious emissions within 18–25 GHz, high channel*

Table 8.3-3: *Radiated field strength measurement results*

Channel	Frequency, MHz	Peak Field strength, dBµV/m		Margin, dB	Average Field strength, dBµV/m		Margin, dB
		Measured	Limit		Measured	Limit	
Low	1188.1	52.11	74.00	21.89	52.11	54.00	1.89
Low	2390.0	47.83	74.00	26.17	47.83	54.00	6.17
Low	4803.6	55.21	74.00	18.79	47.94	54.00	6.06
Low	1200.9	60.74	74.00	13.26	52.64	54.00	1.36
Mid	1187.9	50.89	74.00	23.11	50.89	54.00	3.11
Mid	7320.3	59.71	74.00	14.29	52.31	54.00	1.69
High	1187.9	52.34	74.00	21.66	52.34	54.00	1.66
High	2483.5	48.89	74.00	25.11	48.89	54.00	5.11
High	7439.3	59.09	74.00	14.91	51.28	54.00	2.72
High	9920.5	58.77	74.00	15.23	51.60	54.00	2.40

Notes: Field strength includes correction factor of antenna, cable loss, amplifier, and attenuators where applicable.

8.4 (峰值传输电功率密度) Power spectral density for digitally modulated devices

8.4.1 References, definitions and limits

LP0002, Clause 4.10.1.6:

Other limits:

(2) Digital modulation techniques system:

(B) For digitally modulated systems, the peak power spectral density conducted from the intentional radiator to the antenna shall be less than or equal to 8 dBm in any 3 kHz band during any time interval of continuous transmission, and shall reduce the power spectral density requirement according to the Section 4.10.1.3.

8.4.2 Test summary

Verdict	Pass		
Tested by	Andrey Adelberg	Test date	April 15, 2021

8.4.3 Observations, settings and special notes

Power spectral density test was performed as per KDB 558074, section 8.4 with reference to ANSI C63.10 subclause 11.10.
The test was performed using method PKPSD (peak PSD).
Spectrum analyser settings:

Resolution bandwidth:	3 kHz
Video bandwidth:	≥3 × RBW
Frequency span:	5 MHz (1 Mbps) and 10 MHz (2 Mbps)
Detector mode:	Peak
Trace mode:	Max-hold

8.4.4 Test data

Table 8.4-1: *PSD results (antenna port measurement)*

Data rate, Mbps	Frequency, MHz	PSD, dBm/3 kHz	PSD limit, dBm/3 kHz	Margin, dB
1	2402	-6.70	8.00	14.70
1	2440	-5.90	8.00	13.90
1	2480	-7.59	8.00	15.59
2	2402	-9.12	8.00	17.12
2	2440	-8.59	8.00	16.59
2	2480	-9.42	8.00	17.42

Test data, continued

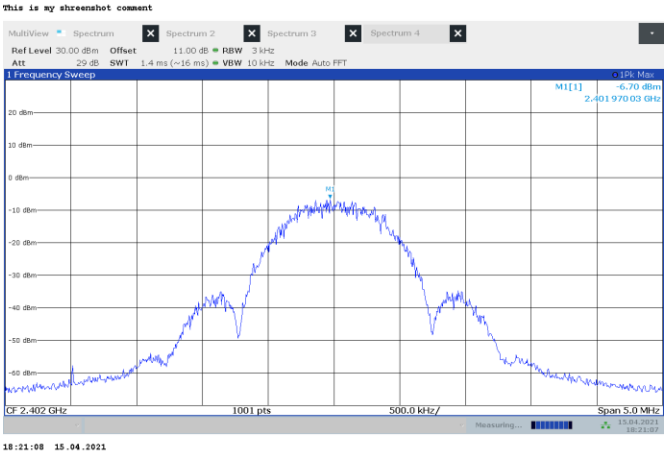

Figure 8.4-1: *PSD on low channel at 1 Mbps*

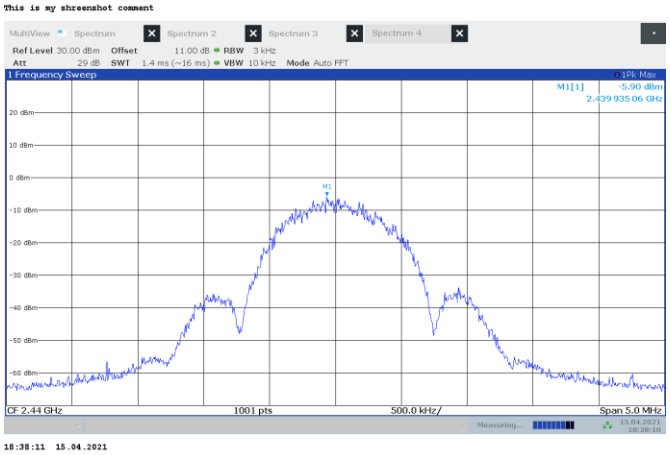

Figure 8.4-2: *PSD on mid channel at 1 Mbps*

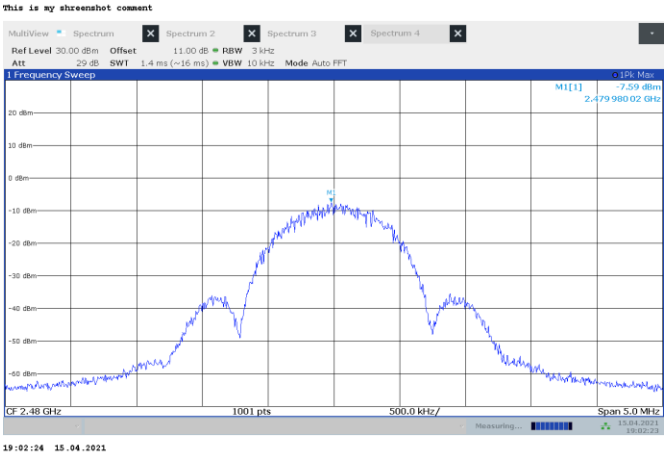

Figure 8.4-3: *PSD on high channel at 1 Mbps*

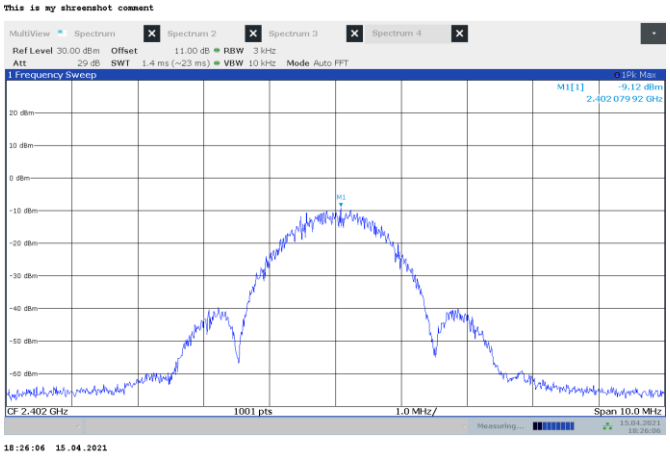

Figure 8.4-4: *PSD on low channel at 2 Mbps*

Test data, continued

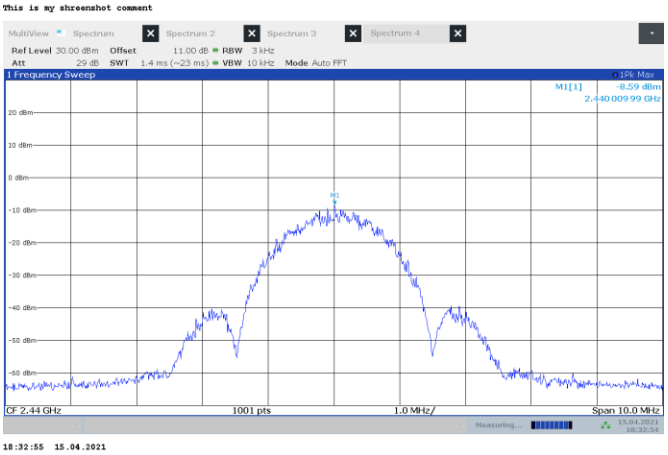

Figure 8.4-5: *PSD on mid channel at 2 Mbps*

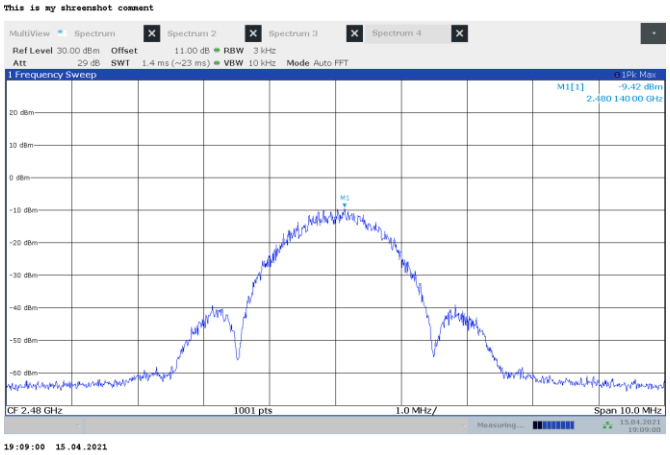

Figure 8.4-6: *PSD on high channel at 2 Mbps*

EUT photos

9.1 External photos

Sec

Figure 9.1-1: *Front and back view photos*

Figure 9.1-2: *Side view photos*

Figure 9.1-3: *Top and bottom view photos*

Figure 9.1-4: *Internal view photo*

End of the test report